MARKED UP VERSION OF CLAIMS WITH MARKING TO SHOW CHANGES MADE

Claim 1. (Currently Amended) A cleaning device comprising a shaped body made of porous polyvinyl acetal material having a uniform pore ~~openings~~ throughout the material with over 90% of the pore ~~openings~~ ranging from about 7 microns to about 40 microns in size.

Claim 2. (Original) A cleaning device as claimed in claim 1 wherein said device is a roller having a smooth outer surface.

Claim 3. (Original) A cleaning device as claimed in claim 1 wherein said device is a pad.

Claim 4. (Original) A cleaning device as claimed in claim 1 wherein said device is a disk.

Claim 5. (Previously Presented) A cleaning device as claimed in claim 1 wherein said polyvinyl acetal material has an average pore opening of about 20 microns.

Claim 6. (Previously Presented) A cleaning device as claimed in claim 1 wherein said material has about 95% of its pores openings below 40 microns.

Claim 7. (Currently Amended) A cleaning device comprising a body made of porous polyvinyl acetal material said polyvinyl <u>acetal</u> material having a bubble point pressure of about 0.026 PSI.

Claim 8. (Original) A cleaning device as claimed in claim 2 wherein said roller has an outside diameter of about 60mm and an inside diameter of about 30mm with a thickness of about 15mm.

Claim 9. (Original) A cleaning device as claimed in claim 1 wherein said material has a mean flow pore pressure of about 0.33 PSI.

Claim 10 (Currently Amended) A semiconductor cleaning device comprising a body

made of porous polyvinyl acetal material with a cylindrical roller shape and a smooth outer surface, said material having uniform gaseous formed pore sizes ~~openings~~ throughout with at least 90% of the pores ranging from about 7 microns to about 40 microns in size with a fluid flow through rate which does not distort the roller when fluid is passed through it to clean the same.

Claim 11. (Currently Amended) A semiconductor cleaning device as claimed in claim 10 wherein said polyvinyl acetal material has an average pore size ~~opening~~ of about 20 microns.

Claim 12. (Currently Amended) A semiconductor cleaning device as claimed in claim 10 wherein said material has 95% of its pores with a ~~an opening~~ size below 40 microns.

Claim 13. (Previously Presented) A semiconductor cleaning device comprising a shaped body made of porous polyvinyl acetal material with gas formed pores and having at least 95% of its pores with an opening size under 40 microns.

Claim 14. (Original) A semiconductor cleaning device as claimed in claim 10 wherein said roller is substantially skinless.

Claim 15. (Original) A semiconductor cleaning device as claimed in claim 10 wherein said material has a mean flow pore pressure of about 0.33 PSI.

Claim 16. (Currently Amended) A semiconductor cleaning device comprising a body made of porous polyvinyl acetal material having a uniform pore size throughout the material with at least 95% of the pores being less than 40 microns in ~~opening~~ size, said material having a mean flow pore ~~opening~~ size of about 20 microns.

Claim 17. (Original) A semiconductor cleaning device as claimed in claim 16 wherein said material has a mean flow pressure of about 0.33PSI.

Claim 18. (Previously Presented) A semiconductor cleaning device comprising a substantially cylindrical roller body made of polyvinyl acetal with a smooth outer surface and uniform

material porosity having a mean flow pore pressure of about 0.30 PSI with 90% of its pores ranging from 7 to 40 microns in size and a wet flow rate using water as a medium ranging from about 7.0 L/min to 80.0 L/min, said pores forming substantially empty cavities.

Claim 19. (Original) A semiconductor cleaning device as claimed in claim 18 wherein cleaning solvent flow through said roller ranges from 120 - 180 ml/minute.

Claim 20. (Previously Presented) A semiconductor cleaning device comprising a substantially cylindrical roller body made of polyvinyl acetal with a smooth outer surface and uniform material porosity having a mean flow pore pressure of about 0.30 PSI with 90% of its pores ranging from 7 to 40 microns in size and a dry flow rate ranging from about 25.0 L/min to 95.0 L/min, said pores forming substantially empty cavities.

Claim 21. (Currently Amended) A semiconductor cleaning device as claimed in claim 18 wherein said roller body polyvinyl acetal material has less than 0.1 ppm formaldehyde ~~PPM~~.

Claim 22. (Previously Presented) A cleaning device as claimed in claim 1 wherein said device is a roller.

REMARKS

Applicant traverses the rejections of claims 1-22 under 35 U.S. C. 103(a) by combining the references of Bahten 6,079,662 with Rosenblatt 4,098,728 and claims 1,2, 5-7 and 9-22 under 35 U.S.C. 103(a) by combining the references of Tomita et al. 4,566,911 with Rosenblatt '728.

Applicant also traverses the Examiners rejection of claims 1-6 and 8-17 under 35 U.S.C. 112. Applicant would point out to the Examiner that the original claims were presented as pore sizes and were requested to be changed by the previous examiner even though such descriptive terminology is common in the art. The claims were then amended to reflect a pore size opening as requested by the prior Examiner. The claims have now been amended to change "opening" back to "size" as requested by the Examiner.

Contrary to the assertions of the Examiner based on no knowledge, the Declaration of Thomas J. Drury is simply a verbal summary analysis of a product test conducted by an independent third party, who has leading edge skill and knowledge in the field and ranks as one of the top companies in the world, in the production of silicon wafer processing equipment. A copy of this test which had been previously requested to remain confidential is attached (Exhibit 1). The Examiner can undertake the calculations to verify the comments made by Mr. Drury in summarizing same. This formal test result, by an entity which would be most critical of the results, as they have a direct bearing on the warranty, and recommended product life of the rollers used in the manufacturers machines show conclusively that the present invention has surprising results over the roller products currently being used; namely, the doubling of the effective use life of the roller, a minus defect rate and a significant reduction of chemical and water usage, any one of which would be a surprising or unexpected result. **A minus defect rate means that the inventive rollers cure manufacturing defects which occur in other areas of the chip manufacture.** The prior art rollers used during the chip cleaning process have positive defect rates meaning that certain percentages of chips were rendered unsuitable for use because of the damage caused by the roller and associated chemical and water used in cleaning. The chip machinery manufacturer was so impressed with the results of the inventive rollers that it has indicated its intention to enter into an OEM relationship with Applicant. Other testing and comment by those skilled in the art are attached in the declaration of Drury as Exhibit 2.

The present product fully meets the rigors of today's CMP methods. While the examiner has combined the attributes of three different patents to form an obviousness rejection, until the present invention was developed, this was impossible. Some patents use starch for the pore former while others use air as the pore former. These are not combined. The invention combines all of the good physical attributes of a starch (finite sized pore former) based product Tomita/Bahten with the good attributes of a gas or air (strength, durability) formed product Rosenblatt, Cercone, to produce a product superior to any of the cited prior art. The production of product is either by starch or by air and the same are not combined in the manufacturing process.

Applicant notes the withdraw of Cercone et '573 from the rejection, but it still should be considered as prior art knowledge teaching away from the present invention. The Rosenblatt 4,098,728 patent refers to an air or gas formed polyvinyl acetal sponge product with a very wide range of pore size. The previous cited Cercone patent is an extension of the Rosenblatt technology. The fact that the pore range is so wide, means that the pore size is really not controlled. A range of 10 to 200 microns produces an inconsistent product with various pore wall thicknesses. Rosenblatt '728 has pore sizes ranging between 0.1mm to 4.0 mm (Example 1: 0.1 -0.5 mm; Example 2: 0.3 - 1.0 mm; Example 3: 0.5 - 4.0 mm; Example 6 0.25 - 1.75 mm)As the cells (pores) of the sponge are formed a bubble of air or gas is surrounded by PVA foam thereby forming a pore. With Rosenblatt '728, the pore size can not be controlled in a tight range. (See Rosenblatt '728 Col. 5 lns 28 - 40) The more open the range the greater the variability. In forming the product into a cast or molded form, these variable pores collapse on the surface and form an inconsistent skin on the surface of the sponge which is shown by Figure 4 of '573 Cercone et al and clearly teaches away from the present invention. This negatively impacts the flow rate and the surface properties of this type of roller/brush which is prone to have variable cleaning capability. In use, these brushes have even scratched the surface of the wafers rendering them useless. This product has not been readily accepted by users in the market place.

Applicant is completely familiar with Rosenblatt and Cercone having worked with both of them for a number of years.

The Tomita 4,566,911 patent which has been in existence over 17 years has a finite pore formed product which uses starch or other pore formers to produce pores in the foam in a range of 10 to 200 microns. Applicant is also familiar and knowledgeable with this product. There is no teaching of the specific narrow pore size range or flow characteristics of the present invention. With

the use of a solid pore former, a finite sized grain is mixed in with the foam slurry) The cell or pore is formed when the slurry sets up around the grain. The starch acts as a bridge for the foam until the product is cured and then the starch or pore former is washed out leaving a pore. The problems with this type of foam are several fold. First, as the pore former acts as a support for the foam, the foam is weakened when the pore former is washed out. Some minor tearing can even occur during the flushing process which shows a weak stringy type pore under high magnification. These weakened pores tend to breakdown when using today's IPA based cleaning solutions, interrupting liquid flow and producing negative cleaning results. Secondly, many of the pore forming grains can remain trapped in the material after it is cured and after the material washing, only releasing in use, which causes contamination of the process. This makes for a much dirtier sponge. See the discussion in Bahten '662 below. When this product is formed, both sponge and starch combine to make a surface skin. This skin requires that the liquid flow pressure be greater to push the cleaning solution through the brush/roller. This results in higher chemistry (water and chemicals) usage and greater stress and breakdown of the skin material resulting in a shorter use life.

The Bahten 6,076,662 patent (assigned to Rippey Corporation) is primarily directed toward a cleaning device for PVA brushes. Bahten '662 specifically that the pore size in some embodiments ranges from about 10 microns to about 200 microns and where the average pore size is less than 10 microns the material may have poor elasticity making the performance fo the cleaning roll unsatisfactory. This is basically the same recitation as that of the Tomita '911 patent. The production of Bahten '662 requires adding of a starch to form the pores but does note that other techniques such as an injected foam can be used. (Col 4 lines 45 - 49). It is also noted that other competitive brushes have more impurities. **Of significant interest is the listing on Col 7 lines 35 -44 of Bahten '662 which notes that the rollers of Merocel Scientific Products (Cercone et al '573) and Kanebo Ltd (Tomita et al '911) include a wide variety of impurities that can be detrimental to the manufacture of integrated circuits.** As noted on Col. 7 lines 33,34, the Bahten '662 process has a first step providing a plurality of porous polymeric devices which require cleaning. **These are products which have just been manufactured.** Twelve additional complex cleaning steps are required to remove particulate contamination and impurities from the porous polymeric devices. The devices are noted as being "dirty" from the manufacturing process and should be substantially cleaned before use in the manufacturing operation, e.g. semiconductor fabrication. After cleaning a preservative is added such as ammonium hydroxide or other organic biocide and the roller

is then packaged. After the cleaning steps are accomplished, the product still contains a number of impurities which seriously impact on it product life and defect ratio of silicone wafters. The Examiners comment that this application is not a product by process claim is a straw argument. This twelve step requirement was specifically pointed out to show that contrary to the allegations of the Examiner, the product of Bahten '662 is inherently dirty which means that substantial impurities would remain after washing as the impurities are held in the foam during curing. There has been no prima facie rejection and the test results show that such problems are still in existence.

In regard to claim 20, the Examiner argument that it is believed (by him) that the cleaning device of Bahten'662 in view of Rosenblatt '728 inherently posses a mean flow pore pressure and a wet flow rate using water (the basis for measuring same) as the present application teaches is not borne out by any facts and is merely a supposition. Furthermore the statement that it would have been obvious to one of ordinary skill in the art to remove the residual formaldehyde to less than 0.1 ppm, motivated by the desire to minimize the impurities in the cleaning devices it not borne out in fact as all devices currently in use which use formaldehyde as the curing agent currently have a residual formaldehyde which is far in excess of this amount despite multiple washings or cleaning of the product.

The Examiners allegation that the substantially skinless surface in inherently disclosed by Bahten or an obvious optimization to one of ordinary skill in the art is without merit and not based only any facts but merely upon supposition

It is thus seen that the cited references do not teach or obviate the present invention and that the present invention is not apparent from the prior art . Indeed the references cannot be combined as they use different pore forming techniques in the PVA. The invention because of its specific range of pore sizes and fluid flow characteristics has a life span more than double the rollers presently being used in the marketplace, uses ½ the chemicals and water currently being used by rollers in the field which are used in the marketplace and has a negative defect rate. As previously noted the inventive rollers when cleaning the silicone wafers do not cause defects as do other competitive rollers) but additionally cure manufacturing defects which occur in the production of the silicone wafers. These are solutions to a long felt need in the industry and are totally unexpected and are surprising results which save large quantities of products, save a significant amount of money in a multibillion dollar industry and have significant environmental benefits.

A three month extension of time and Notice of Appeal together with the requisite fee

has been filed with this amendment. If any additional charges are required, please charge Deposit Account Number 07-1340.

It is respectfully requested that the arguments and amendments present in the present application in condition for favorable reexamination and that the application be passed to issue.

Respectfully submitted,

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Summary

Objective:

- To evaluate, and compare, defect performance of four different brushes, under the same environment.

Tool used:

- 300MM Mirra Messa.

Results:

- BPTone 212XP material (3920-00307) had the best particle removal rate.

Experimental Details For Tool Qualification

Tools

- S3 300mm Mirra-Mesa
  - Megasonics
  - Brush 1
  - Brush 2
  - SRD
- Metrology
  - KLA-Tencor
  - Oxide BKM recipe

Methodology

- Cycle 100 dummy wafers through the system daily
- Testfire 4 oxide defect wafers
- Defect Qualification is < 30 adders (delta = post - pre) at 0.13 μm
- Cleaning Performance Metrics:
  - Delta = precount – postcount (typically used at customer site)
  - Map-to-map defect analysis not available

Experimental Details for Brush Type Evaluation

Methodology

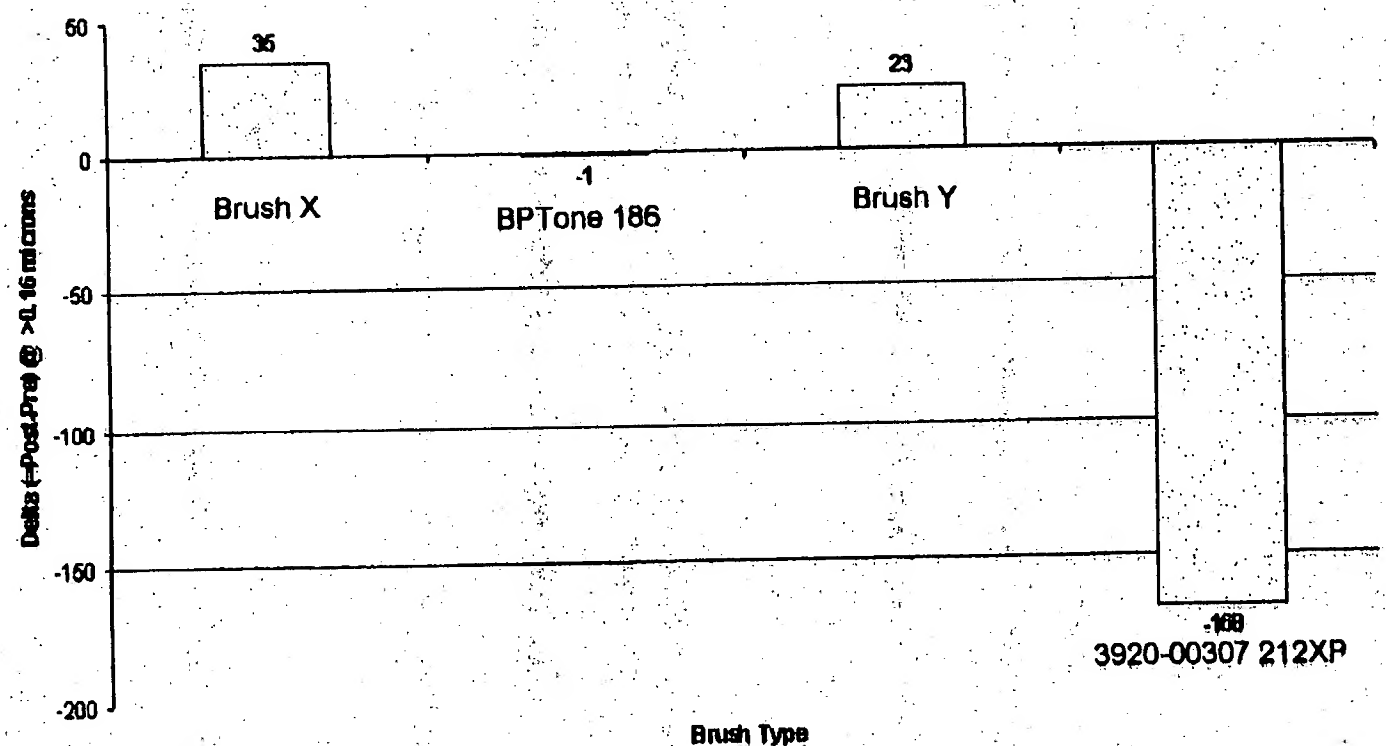
- Install Brushes and Run Brush Break-in twice
- Cycle 25 dummy wafers through system
- Testfire 4 oxide defect wafers for qualification
- Defect Qualification is < 30 adders (delta = post - pre) at 0.13 μm
- Testfire 5+ oxide defect wafers for Using BKM 1.1
- Cleaning Performance Metrics:
  - Delta = precount – postcount (typically used at customer site)
  - Map-to-map defect analysis not available

Objective

Evaluate Four Different Brushes for Brush Module 2

- Brush types
  - Brush X
  - Brush Y
  - BPT-1 Type 186
  - 3920-00307, BPT-1 Type 212

Effect of Different Brush Types



BPT-1 Type 212 Brushes Has Best Defect Performance

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